

Strength Characteristics Of Concrete With Partial Replacement Of Sand By Unprocessed Fly Ash

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Abstract— Concrete is a composite mix which is used for construction of Dams, Buildings, Bridges, Roads etc. due to rapid growth of population in many developing countries like India the problem occurring in scarcity of sand and this is increasing day by day with respect to development of country, so it is necessary to find the alternative material to sand. On the other side due to uncontrolled extraction of sand from river bed causes many adverse impact on the natural environment. At the same time fly ash is a solid residue generated from coal combustion in Thermal power plant. In India availability of fly ash has already exceeded 170 tones and it is likely to increase in future days at faster rate. The disposal of fly ash is also the problem in India. Fly ash can be used to replace the sand partially. In this study sand is replaced partially by the unprocessed fly and compressive strength of the same is checked.

Keywords— Concrete, Ordinary Portland Cement, Sand, Fly Ash, Replacement, Compressive Strength, Curing.

INTRODUCTION

Fine aggregate occupies about 25% to 40% of total volume of concrete and hence provides great opportunity to utilize about 150 kg per m³ waste materials like fly ash for replacement. The need of fly ash utilization also arises out of the fact that good quality Natural River sand required in concrete and in the cement mortar, is depleting day by day and scarcity of good quality sand is felt by all metro and mega cities in India. Also Natural sand is expensive due to high transportation cost from natural resources & due to large scale depletion of these resources creates environmental problem. Hence this study explores the possibility of replacing part of fine aggregate with fly ash and reducing the consumption of natural sand.

SYSTEM DEVELOPMENT— Materials used are as follows.

The materials used in making the concrete are unprocessed fly ash as the source material, aggregate, cement and water. The type cement used is ordinary Portland cement of 53 grade.

AGGREGATES

Local aggregate 20 mm and 12.5mm are coarse aggregate in saturated surface dry condition, were used. The coarse aggregate were crushed ballast type aggregate which are found in Deccan trap region. The fineness modulus of combined aggregate was 4.81. These size fractions are combined in fixed proportion to maintain grading complying with as per IS650: 1991.

SAND

Locally available river sand is used as fine aggregate. The sand is sieved using sieves of sizes 4.75 mm, 2.36 mm, 1.18 mm, 600 micron, 300 micron and 150 micron. The fineness modulus of combined aggregate was 3.43.

Table: Properties of Aggregates

Properties	C A I	C A II	FA(sand)
Type	Crushed angular	Crushed angular	Spherical (River sand)
Maximum Size	20mm	12.5 mm	4.75 mm
Specific Gravity	2.563	2.592	2.593
Grading	Confirming to combination of CA-I : CA-II 65 : 35		Confirming to grading zone-III
Material finer than 75 micron	Nil	Nil	1.30 %
Water Absorption	0.59%	0.91%	1.87%
Moisture Content	Nil	Nil	Nil

MANUFACTURE OF TEST SPECIMENS

The concrete mix is prepared of proportion M (1: 1.5:3) as follows:

- 1) Material is taken on weight basis.
- 2) First aggregate is weighted to nearest gram and placed in mixing tray then sand is weighted and placed uniformly over aggregate. In the same way cement and fly ash is weighted and placed over mix of sand and aggregate.
- 3) Water cement ratio taken is 0.45. Water is then measured accurately in measuring cylinder and is uniformly poured in the mixture of cement, sand and aggregate. Care should be taken that uniformly mixing should be carried out and have uniform color.
- 4) When unprocessed fly ash is used in the mix it is taken on volume basis.

COMPRESSIVE STRENGTH TEST

SIZE OF TEST SPECIMEN-Test specimen cubical in shape shall be 15x15x15cm. The mould shall be 150mm size. In assembling the mould for use, the joints between the sections of mould shall be thinly coated with mould oil and a similar coating of mould oil shall be applied between the contact surfaces of the bottom of the mould and the base plate in order to ensure that no water escapes during the filling. The interior surfaces of the assembled mould shall be thinly coated with mould oil to prevent adhesion of the concrete.

COMPACTION-The test specimens shall be made as soon as practicable after mixing, and in such a way as to produce full compaction of the concrete with neither segregation nor excessive laitance. The concrete shall be filled into the mould in layers approximately 5 cm deep. In placing each scoopful of concrete, the scoop shall be moved around the top edge of the mould as the concrete slides from it, in order to ensure a symmetrical distribution of the concrete within the mould. Each layer shall be compacted by hand. When compacting by hand, the tamping bar shall be used and the strokes of the bar shall be distributed in a uniform manner over the cross-section of the mould. The number of strokes per layer required to produce specified conditions for cubical specimens, in no case shall the concrete be subjected to less than 35 strokes per layer for 15 cm cubes. After the top layer has been compacted, the surface of the concrete shall be finished level with the top of the mould, using a trowel, and covered with a metal plate to prevent

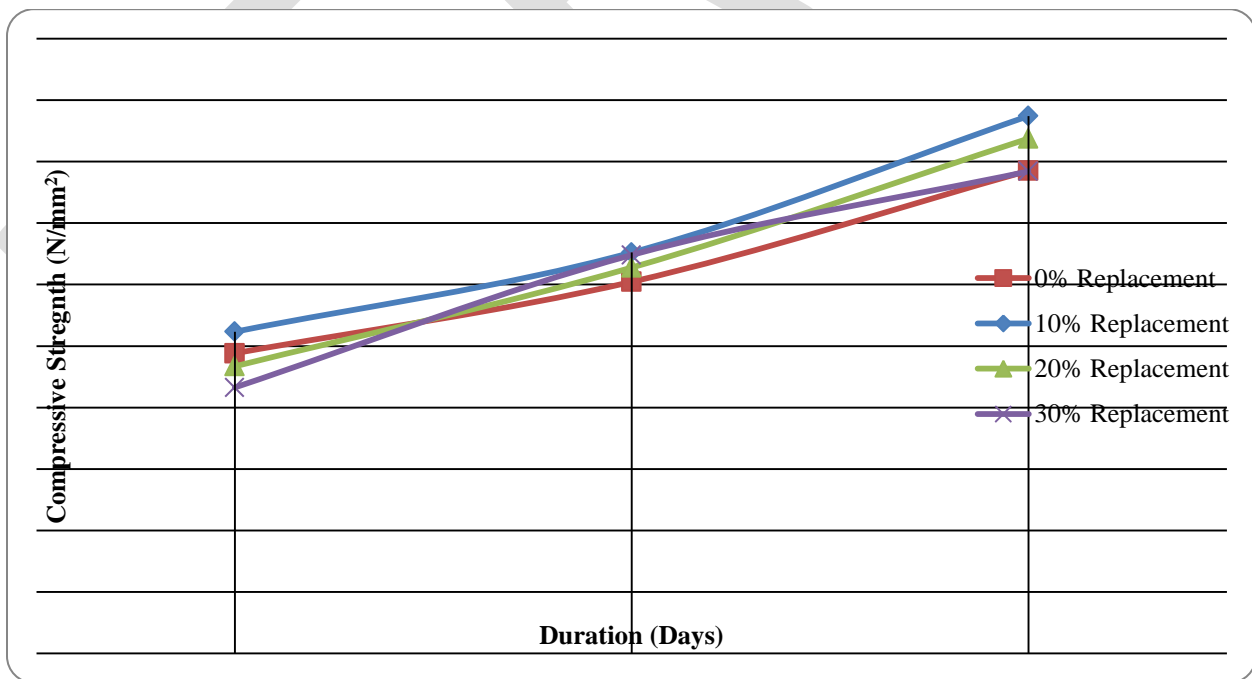
evaporation.

CURING-The test specimens shall be stored in the laboratory at a place free from vibration, under damp matting, for 24 hours \pm ½ hour from the time of adding the water to the other ingredients. The temperature of the place of storage shall be maintained within the range of 22° to 32°C. After the period of 24 hours, they shall be marked for later identification, removed from the moulds and, unless required for testing within 24 hours, stored in clean water at a temperature of 24° to 30°C until they are transported to the testing.

TESTING-Tests shall be made at the 3, 7 & 28day's ages of the specimen. At least three specimens shall be made for testing at each selected age.

PROCEDURE-Specimens stored in water shall be tested immediately on removal from the water and while they are still in the wet condition. Surface water and grit shall be wiped off the specimens and any projecting fins removed. The bearing surfaces of the testing machine shall be wiped clean and any loose sand or other material removed from the surfaces of the specimen which are to be in contact with the compression platens. In the case of cubes, the specimen shall be placed in the machine in such a manner that the load shall be applied to opposite sides of the cubes as cast, that is, not to the top and bottom. The axis of the specimen shall be carefully aligned with the centre of thrust of the spherically seated platen. No packing shall be used between the faces of the test specimen and the steel platen of the testing machine. The load shall be applied without shock and increased continuously at a rate of approximately 140 kg/sq cm/min until the resistance of the specimen to the increasing load breaks down and no greater load can be sustained. The maximum load applied to the specimen shall then be recorded and the appearance of the concrete shall be noted. The measured compressive strength of the specimen shall be calculated by dividing the maximum load applied to the specimen during the test by the cross-sectional area, calculated from the mean dimensions of the section (150X150X150mm) and shall be expressed to the nearest N per sq mm. Average of three values shall be taken as the representative of the batch provided.

RESULT- The details are given below



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CONCLUSION

The conclusions drawn are summarized as follows,

1. Compressive strength of concrete could be slightly increases up to 10% replacement of sand by unprocessed fly ash and later decreases as a percentage of unprocessed fly ash in concrete increases.
2. The maximum compressive strength of concrete could be occur when 10% sand was replaced by unprocessed fly ash.

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